



UNITED STATES ARMY AVIATION AND MISSILE COMMAND Lifecycle Management Command



U.S. Army Aviation & Missile Command Hexavalent Chromium Coatings Replacement Program

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Test Program Background



- **AMCOM Testing effort focused on the performance of the coating system**
 - **Technical approach was more holistic**
 - **Focus was on coating system performance vice individual system component capabilities**
- **Test Program leveraged off of other DoD and commercial test efforts**
 - **NAVAIR – ESTCP Non-Chrome Aluminum Pretreatments**
 - **Air Force - PreKote**
 - **Air Force/NAVAIR Non-Chrome Epoxy Primer**
 - **Deft/Hentzen Class N Primer development**



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Test Program Background



- **Testing performed Fall/Winter/Spring 2003-2004 at NAVAIR Patuxent River and ARL Aberdeen**
 - NAVAIR performed pretreatment and coating application
 - ARL performed corrosion, EIS and adhesion testing on the coated samples
 - ASTM Adhesion testing performed on both wet and dry samples
 - Corrosion testing evaluated samples in neutral salt fog (B117) and Cyclic (GM9540)



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Test Program Background



- **Substrate Materials evaluated included:**
 - 2024 and 7075 Aluminum (T6 tempers) various test pretreatments
 - 4340 High Strength Steel (Cd plated)
 - ZE41A Magnesium (Dow 17 and PreKote Treated)
 - G11 Composite (no pretreatment)
- **Coating Products Evaluated**
 - Class N Primer (MIL-PRF-85582 Type I)
 - MIL-DTL-53039 and 64159 CARCs
 - Alternate conversion coatings: Alodine 5700, Alodine T5900RTU and PreKote



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Test Program Background



- **Test results indicated the following materials were the best non-hexavalent chromium products**
 - **MIL-DTL-81706 Type II (TCP)**
 - **4 Manufacturers have qualified products**
 - Products available as concentrates or ready-to-use
 - NSNs requested and Army transition will follow
 - **MIL-PRF-23377 Class N**
 - **2 Manufacturers have qualified products**
 - NSNs obtained and Army transition in-progress



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ON-AIRCRAFT TESTING



- Initial Test coating applied to CH-47 by 1109th Aviation Classification Repair Activity Depot (AVCRAD) Groton Fall 2005
 - Pretreatment MIL-DTL-81706 Type II (TCP)
 - Upper fuselage received a Class C primer, lower fuselage the Class N primer
 - MIL-DTL-64159 Type II CARC
- Additional coating applications continued at the 1109th AVCRAD throughout 2006 and 2007
 - New coating system used on CH-47, UH-60 and AH-64 rotary-wing aircraft



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Non-hexavalent Chromium Primers



- **Several Class N Primers are now available for use**
- **MIL-PRF-23377 Type I and II Class N NSNs**
 - **Type I – 8010-01-555-3381 (1 Gal Kit)**
 - **Mfr P/N 16708TEP/16709CEH Hentzen**
 - **Mfr P/N 02GN084 (Deft)**
 - **Type I – 8010-01-555-3386 (1 Quart Kit)**
 - **Same P/N**
 - **Type II – 8010-01-555-3383 (1 Gal Kit)**
 - **Mfr P/N – 17176KEP/16709CEH (Hentzen)**



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Non-hexavalent Chromium Primers



- **MIL-PRF-85582 Type I and II Class N NSNs**
 - **Type I – 8010-01-555-3385 (1 Gal Kit)**
 - Mfr P/N - 44GN098 (Deft)
 - **Type I – 8010-01-555-3388 (1 Quart Kit)**
 - Mfr P/N - 44GN098 (Deft)
 - **Existing NSNs for MIL-PRF-85582 Type I and II Class N**
 - 8010-01-466-9037 (Type I 2-Gal/Kit)
 - 8010-01-466-9313 (Type II 2-Gal/Kit)



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Non-hexavalent Chromium Primers Issues

- **AMCOM Authorization for the use of Class N Primers in-progress**
 - Maintenance Information Message (MIM) will be distributed when NSNs have been added to the Authorized Users List (AUL) for Aviation Systems and Equipment (in-progress)
 - Per discussion with the Integrated Material Management Center (IMMC), the MIM is still at Aviation Safety awaiting final approval before distribution
 - Follow-on MIMs will be issued for MIL-DTL-81706 Type II products when NSNs have been assigned



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MIL-DTL-81706



- Request has been submitted to the GSA for NSN Assignment for MIL-DTL-81706 Type II Class 1a and 3 products (Trivalent Chromium Process – TCP)
 - Type II products do not use hexavalent chromium (Cr^{+6})
 - Primer adhesion in many applications is improved over Type I conversion coatings
 - Corrosion inhibition performance not impacted by elevated temperatures
 - No breakdown when used under powder coatings cured at temperatures that would damage Type I conversion coatings



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MIL-DTL-81706



- **May be other potential applications for the TCP materials**
 - **Testing is in-process to evaluate TCP as a seal coating over:**
 - **Acid and alkaline zinc-nickel plate**
 - **Zinc plate**
 - **Phosphate treatments over steel**
 - **Final rinse/seal over hard anodized aluminum**



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NEW CARC MIL-DTL-53039



- **New CARC coatings conforming to MIL-DTL-53039 Type II will be available in the near future**
 - Type II products contain <1.5 lb/gal VOCs and 0 Volatile Hazardous Air Pollutants
 - CARCs use either silica or polymeric bead flattening
 - New NSNs to be assigned to differentiate from older MIL-C- or MIL-DTL-53039 coatings



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NEW CARC COATINGS



- New '53039 Type II Beaded CARC will initially be available in the most common Aviation colors:
 - Aircraft Green (Color No. 34031),
 - Aircraft Black (Color No. 37038),
 - Aircraft Interior Black (Color No. 37031) and
 - Aircraft Interior Grey (Color No. 36231)
 - Still awaiting final qualification of the new Desert Sage color (Color No. 34201) for the CH-47
 - Insignia Blue (35044), Aircraft Red (31136), Aircraft White (37875) will be available as a Type I coating for the immediate future (silica flatteners)



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NEW COATING TRANSITION



- When changing to the new primer and CARC coatings initial results were mixed
 - AVCRAD personnel closely followed mix/application guidelines with OEM techreps present
 - No noted difficulties and good results
 - Other facility painters did not review technical guidelines and proceeded to apply the new primer like the previous products
 - Inadequate mixing resulted in some of the coating failures
 - Wet/dry film thickness was not properly controlled
 - Improper paint gun settings and tip orifice sizes resulted in poor control of the applied coating
 - Top-coating was applied before primer had sufficient time to fully cure



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PAINTING INFRASTRUCTURE



- **G-4/Coating OEM performed an on-site assessment of the painting operations at a primary AMCOM facility**
- **Personnel provided recommendations to improve painting operations, maximize productivity, minimize waste:**
- **Infrastructure review focused on several contributing areas:**
 - **Storage areas need to be less exposed to wide temperature swings**
 - **Mixing Equipment**
 - **Single or Dual Arm aggressive paint “shakers” are needed to properly mix the new high solids primer and CARC coatings**
 - **Proper process needs to be followed to mix the two-component coatings**



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PAINTING INFRASTRUCTURE



- **Infrastructure review (continued):**

- **Application Equipment**

- **High Volume/Low Pressure (HVLP) guns**

- All of the paint guns in each paint shop should be standardized (standardized in entire facility would be best)
 - » Proper repair parts must be available in each shop
 - Proper tip orifice critical with the new coatings

- **Paint pots that use vertical or paddle agitators to keep suspended solids evenly distributed are required**

- Proper operation of in-pot agitators is important
 - Paint pots must be kept on optimum condition



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PAINTING INFRASTRUCTURE



- **Infrastructure Review** (continued)

- **Supply air**

- Supply air systems must provide sufficient pressure and volume
 - Inline air dryers to ensure air supplied to pressure pot/gun is moisture- and oil-free
 - Easily accessible and operable traps and blow downs to keep air lines contaminant free
 - Regular inspections and maintenance on the systems to maintain top performance
 - Airlines should be properly sized and configured for optimum performance
 - Separate supply lines for pot pressurization and atomization air



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PAINTING INFRASTRUCTURE



- **Infrastructure Review (continued)**

- **Paint Booth Climate Controls**

- Need to keep the booth at a nominal 50% relative humidity
 - Control temperatures in the booth at:
 - 70°F or above (winter months),
 - 90°F or below (summer months)
 - Aircraft should be acclimated to the booth temperature prior to coating application



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PAINTING PROCESSES



- **New Primers and CARCs are not the same coatings as previously used**
 - **Transition to the new coatings will require painter familiarization with the coating prior to spraying an aircraft**
 - **Hands-on training and test panel spraying recommended prior to 1st application on an aircraft**
 - **Training should emphasize:**
 - **Understanding ambient condition impacts on coating application and drying**
 - » **Temperature and humidity**
 - **Proper mixing**
 - **Sufficient drying time between coating applications**
 - **Controlling wet-film thickness and edge blending**



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